State of California
The Resources Agency
Department of Water Resources

SP-F3.1 TASK 5A REPORT: ONE-MILE POND FISH SPECIES COMPOSITION

Oroville Facilities Relicensing
FERC Project No. 2100

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REPORT SUMMARY

These study results identify the fish species composition in the Oroville Wildlife Area and represent task 5A of SP-F3.1 study entitled, *SP-F3.1 Evaluation of Project Effects on Fish and Their Habitat within Lake Oroville, its Upstream Tributaries, the Thermalito Complex, and the Oroville Wildlife Area.*

Information from this study report will be used to identify the potential impacts of the project on these fishery resources, and in the development of potential protection, mitigation and enhancements (PM&Es) (resource actions) for the project. Related study plans that will use this study for information include SP-F2, SP-F3.2, SP-F5/7, as well as in the recreation analyses of SP-R4, SP-R13, and SP-R17.

A listing of the fish species is presented along with a general perspective as to the relative abundance of these species, and the relationship of these fish species compositions to existing fishery management programs is also discussed.

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1.0 INTRODUCTION

These study results identify the fish species composition in the Oroville Wildlife Area (OWA) and represent task 5A of the SP-F3.1 study entitled, *SP-F3.1 Evaluation of Project Effects on Fish and Their Habitat within Lake Oroville, its Upstream Tributaries, the Thermalito Complex, and the Oroville Wildlife Area.* Information from this study will be used to identify the potential impacts of the project on these fishery resources, and in the development of potential protection, mitigation and enhancements (PM&Es) (resource actions) for the project.

1.1 STUDY AREA

The study area for this report is the "borrow area" of the Oroville Wildlife Area located along the Feather River; specifically One-Mile Pond and Robinson's Pond. The Thermalito Afterbay component of the OWA will be covered in a separate report.

1.2 DESCRIPTION OF FACILITIES

The Oroville Facilities were developed as part of the State Water Project (SWP), a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. The main purpose of the SWP is to store and distribute water to supplement the needs of urban and agricultural water users in northern California, the San Francisco Bay area, the San Joaquin Valley, and southern California. The Oroville Facilities are also operated for flood management, power generation, to improve water quality in the Delta, provide recreation, and enhance fish and wildlife.

FERC Project No. 2100 encompasses 41,100 acres and includes Oroville Dam and Reservoir, three power plants (Hyatt Pumping-Generating Plant, Thermalito Diversion Dam Power Plant, and Thermalito Pumping-Generating Plant), Thermalito Diversion Dam, the Feather River Fish Hatchery and Fish Barrier Dam, Thermalito Power Canal, Oroville Wildlife Area (OWA), Thermalito Forebay and Forebay Dam, Thermalito Afterbay and Afterbay Dam, and transmission lines, as well as a number of recreational facilities. An overview of these facilities is provided on Figure 1.2-1. The Oroville Dam, along with two small saddle dams, impounds Lake Oroville, a 3.5-million-acre-feet (maf) capacity storage reservoir with a surface area of 15,810 acres at its normal maximum operating level.

The hydroelectric facilities have a combined licensed generating capacity of approximately 762 megawatts (MW). The Hyatt Pumping-Generating Plant is the largest of the three power plants with a capacity of 645 MW. Water from the six-unit underground power plant (three conventional generating and three pumping-generating units) is discharged through two tunnels into the Feather River just downstream of

Oroville Dam. The plant has a generating and pumping flow capacity of 16,950 cfs and 5,610 cfs, respectively. Other generation facilities include the 3-MW Thermalito Diversion Dam Power Plant and the 114-MW Thermalito Pumping-Generating Plant.

Thermalito Diversion Dam, four miles downstream of the Oroville Dam creates a tail water pool for the Hyatt Pumping-Generating Plant and is used to divert water to the Thermalito Power Canal. The Thermalito Diversion Dam Power Plant is a 3-MW power plant located on the left abutment of the Diversion Dam. The power plant releases a maximum of 615 cubic feet per second (cfs) of water into the river.

The Power Canal is a 10,000-foot-long channel designed to convey generating flows of 16,900 cfs to the Thermalito Forebay and pump-back flows to the Hyatt Pumping-Generating Plant. The Thermalito Forebay is an off-stream regulating reservoir for the 114-MW Thermalito Pumping-Generating Plant. The Thermalito Pumping-Generating Plant is designed to operate in tandem with the Hyatt Pumping-Generating Plant and has generating and pump-back flow capacities of 17,400 cfs and 9,120 cfs, respectively. When in generating mode, the Thermalito Pumping-Generating Plant discharges into the Thermalito Afterbay, which is contained by a 42,000-foot-long earth-fill dam. The Afterbay is used to release water into the Feather River downstream of the Oroville Facilities, helps regulate the power system, provides storage for pump-back operations, and provides recreational opportunities. Several local irrigation districts receive water from the Afterbay.

The Feather River Fish Barrier Dam is downstream of the Thermalito Diversion Dam and immediately upstream of the Feather River Fish Hatchery. The flow over the dam maintains fish habitat in the low-flow channel of the Feather River between the dam and the Afterbay outlet, and provides attraction flow for the hatchery. The hatchery was intended to compensate for spawning grounds lost to returning salmon and steelhead trout from the construction of Oroville Dam. The hatchery can accommodate 15,000 to 20,000 adult fish annually.

The Oroville Facilities support a wide variety of recreational opportunities. They include: boating (several types), fishing (several types), fully developed and primitive camping (including boat-in and floating sites), picnicking, swimming, horseback riding, hiking, off-road bicycle riding, wildlife watching, hunting, and visitor information sites with cultural and informational displays about the developed facilities and the natural environment. There are major recreation facilities at Loafer Creek, Bidwell Canyon, the Spillway, North and South Thermalito Forebay, and Lime Saddle. Lake Oroville has two full-service marinas, five car-top boat launch ramps, ten floating campsites, and seven dispersed floating toilets. There are also recreation facilities at the Visitor Center and the OWA.

The OWA comprises approximately 11,000-acres west of Oroville that is managed for wildlife habitat and recreational activities. It includes the Thermalito Afterbay and

surrounding lands (approximately 6,000 acres) along with 5,000 acres adjoining the Feather River. The 5,000 acre area straddles 12 miles of the Feather River, which includes willow and cottonwood lined ponds, islands, and channels. Recreation areas include dispersed recreation (hunting, fishing, and bird watching), plus recreation at developed sites, including Monument Hill day use area, model airplane grounds, three boat launches on the Afterbay and two on the river, and two primitive camping areas. California Department of Fish and Game's (DFG) habitat enhancement program includes a wood duck nest-box program and dry land farming for nesting cover and improved wildlife forage. Limited gravel extraction also occurs in a number of locations.

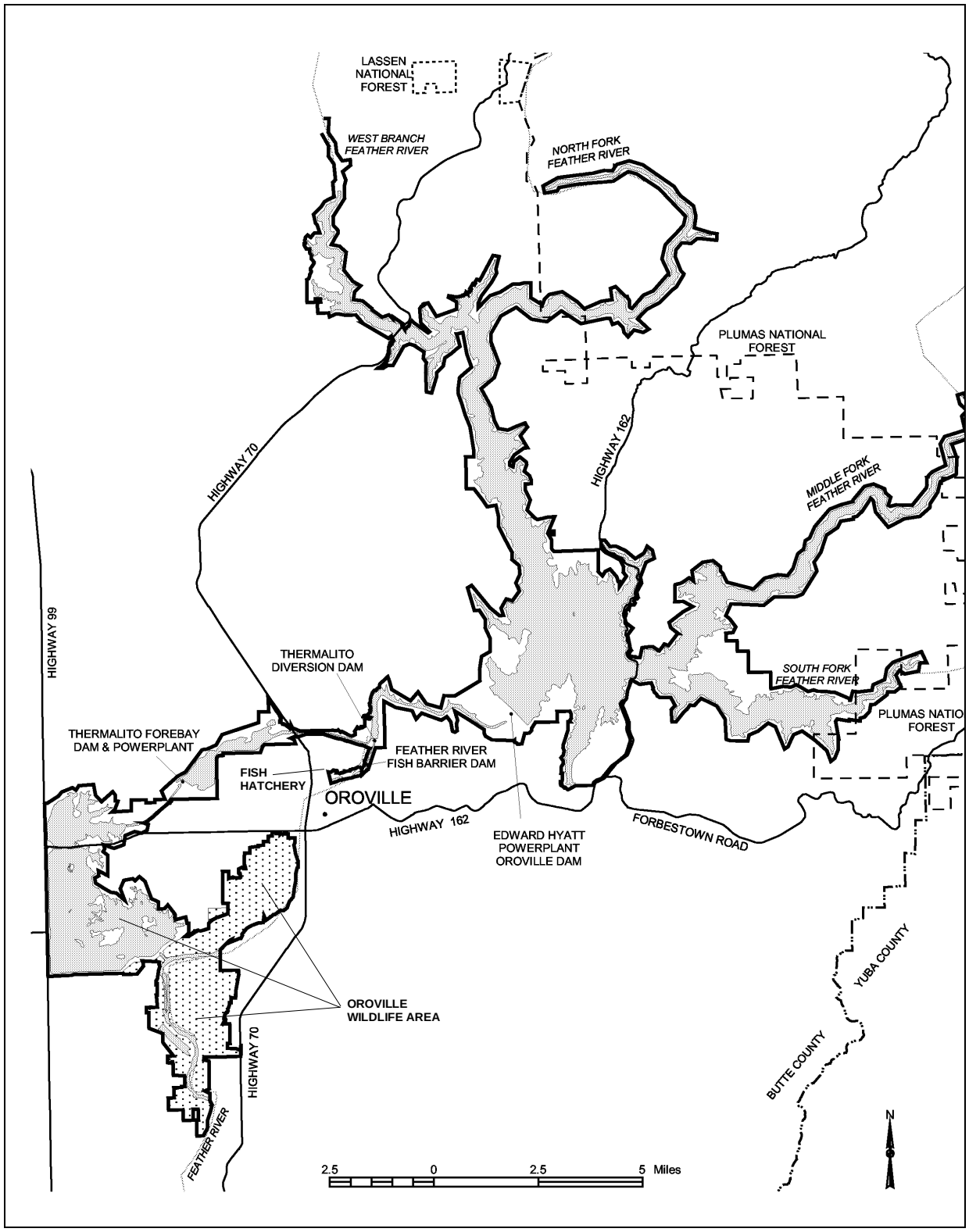

Figure 1.2-1. Oroville Facilities FERC Project Boundary

1.3 CURRENT OPERATIONAL CONSTRAINTS

Operation of the Oroville Facilities varies seasonally, weekly and hourly, depending on hydrology and the objectives DWR is trying to meet. Typically, releases to the Feather River are managed to conserve water while meeting a variety of water delivery requirements, including flow, temperature, fisheries, recreation, diversion and water quality. Lake Oroville stores winter and spring runoff for release to the Feather River as necessary for project purposes. Meeting the water supply objectives of the SWP has always been the primary consideration for determining Oroville Facilities operation (within the regulatory constraints specified for flood control, in-stream fisheries, and downstream uses). Power production is scheduled within the boundaries specified by the water operations criteria noted above. Annual operations planning is conducted for multi-year carry over. The current methodology is to retain half of the Lake Oroville storage above a specific level for subsequent years. Currently, that level has been established at 1,000,000 acre-feet (af); however, this does not limit draw down of the reservoir below that level. If hydrology is drier than expected or requirements greater than expected, additional water would be released from Lake Oroville. The operations plan is updated regularly to reflect changes in hydrology and downstream operations. Typically, Lake Oroville is filled to its maximum annual level of up to 900 feet above mean sea level (msl) in June and then can be lowered as necessary to meet downstream requirements, to its minimum level in December or January. During drier years, the lake may be drawn down more and may not fill to the desired levels the following spring. Project operations are directly constrained by downstream operational constraints and flood management criteria as described below.

1.3.1 Downstream Operation

An August 1983 agreement between DWR and DFG entitled, “Agreement Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish & Wildlife,” sets criteria and objectives for flow and temperatures in the low flow channel and the reach of the Feather River between Thermalito Afterbay and Verona. This agreement: (1) establishes minimum flows between Thermalito Afterbay Outlet and Verona which vary by water year type; (2) requires flow changes under 2,500 cfs to be reduced by no more than 200 cfs during any 24-hour period, except for flood management, failures, etc.; (3) requires flow stability during the peak of the fall-run Chinook spawning season; and (4) sets an objective of suitable temperature conditions during the fall months for salmon and during the later spring/summer for shad and striped bass.

1.3.1.1 Instream Flow Requirements

The Oroville Facilities are operated to meet minimum flows in the Lower Feather River as established by the 1983 agreement (see above). The agreement specifies that Oroville Facilities release a minimum of 600 cfs into the Feather River from the

Thermalito Diversion Dam for fisheries purposes. This is the total volume of flows from the diversion dam outlet, diversion dam power plant, and the Feather River Fish Hatchery pipeline.

Generally, the instream flow requirements below Thermalito Afterbay are 1,700 cfs from October through March, and 1,000 cfs from April through September. However, if runoff for the previous April through July period is less than 1,942,000 af (i.e., the 1911-1960 mean unimpaired runoff near Oroville), the minimum flow can be reduced to 1,200 cfs from October to February, and 1,000 cfs for March. A maximum flow of 2,500 cfs is maintained from October 15 through November 30 to prevent spawning in overbank areas that might become de-watered.

1.3.1.2 Temperature Requirements

The Diversion Pool provides the water supply for the Feather River Fish Hatchery. The hatchery objectives are 52°F for September, 51°F for October and November, 55°F for December through March, 51°F for April through May 15, 55°F for last half of May, 56°F for June 1-15, 60°F for June 16 through August 15, and 58°F for August 16-31. A temperature range of plus or minus 4°F is allowed for objectives, April through November.

There are several temperature objectives for the Feather River downstream of the Afterbay Outlet. During the fall months, after September 15, the temperatures must be suitable for fall-run Chinook. From May through August, they must be suitable for shad, striped bass, and other warmwater fish.

The National Marine Fisheries Service has also established an explicit criterion for steelhead trout and spring-run Chinook salmon. Memorialized in a biological opinion on the effects of the Central Valley Project and SWP on Central Valley spring-run Chinook and steelhead as a reasonable and prudent measure; DWR is required to control water temperature at Feather River mile 61.6 (Robinson's Riffle in the low-flow channel) from June 1 through September 30. This measure requires water temperatures less than or equal to 65°F on a daily average. The requirement is not intended to preclude pump-back operations at the Oroville Facilities needed to assist the State of California with supplying energy during periods when the California ISO anticipates a Stage 2 or higher alert.

The hatchery and river water temperature objectives sometimes conflict with temperatures desired by agricultural diverters. Under existing agreements, DWR provides water for the Feather River Service Area (FRSA) contractors. The contractors claim a need for warmer water during spring and summer for rice germination and growth (i.e., 65°F from approximately April through mid May, and 59°F during the remainder of the growing season). There is no obligation for DWR to meet the rice

water temperature goals. However, to the extent practical, DWR does use its operational flexibility to accommodate the FRSA contractor's temperature goals.

1.3.1.3 Water Diversions

Monthly irrigation diversions of up to 190,000 (July 2002) af are made from the Thermalito Complex during the May through August irrigation season. Total annual entitlement of the Butte and Sutter County agricultural users is approximately 1 maf. After meeting these local demands, flows into the lower Feather River continue into the Sacramento River and into the Sacramento-San Joaquin Delta. In the northwestern portion of the Delta, water is pumped into the North Bay Aqueduct. In the south Delta, water is diverted into Clifton Court Forebay where the water is stored until it is pumped into the California Aqueduct.

1.3.1.4 Water Quality

Flows through the Delta are maintained to meet Bay-Delta water quality standards arising from DWR's water rights permits. These standards are designed to meet several water quality objectives such as salinity, Delta outflow, river flows, and export limits. The purpose of these objectives is to attain the highest water quality, which is reasonable, considering all demands being made on the Bay-Delta waters. In particular, they protect a wide range of fish and wildlife including Chinook salmon, delta smelt, striped bass, and the habitat of estuarine-dependent species.

1.3.2 Flood Management

The Oroville Facilities are an integral component of the flood management system for the Sacramento Valley. During the wintertime, the Oroville Facilities are operated under flood control requirements specified by the U.S. Army Corps of Engineers (USACE). Under these requirements, Lake Oroville is operated to maintain up to 750,000 af of storage space to allow for the capture of significant inflows. Flood control releases are based on the release schedule in the flood control diagram or the emergency spillway release diagram prepared by the USACE, whichever requires the greater release. Decisions regarding such releases are made in consultation with the USACE.

The flood control requirements are designed for multiple use of reservoir space. During times when flood management space is not required to accomplish flood management objectives, the reservoir space can be used for storing water. From October through March, the maximum allowable storage limit (point at which specific flood release would have to be made) varies from about 2.8 to 3.2 maf to ensure adequate space in Lake Oroville to handle flood flows. The actual encroachment demarcation is based on a wetness index, computed from accumulated basin precipitation. This allows higher levels in the reservoir when the prevailing hydrology is dry while maintaining adequate flood protection. When the wetness index is high in the basin (i.e., wetness in the

watershed above Lake Oroville), the flood management space required is at its greatest amount to provide the necessary flood protection. From April through June, the maximum allowable storage limit is increased as the flooding potential decreases, which allows capture of the higher spring flows for use later in the year. During September, the maximum allowable storage decreases again to prepare for the next flood season. During flood events, actual storage may encroach into the flood reservation zone to prevent or minimize downstream flooding along the Feather River.

2.0 NEED FOR STUDY

These study results identify the fish species composition in One-Mile Pond and represent tasks 5A of the SP-F3.1 study entitled, *SP-F3.1 Evaluation of Project Effects on Fish and Their Habitat within Lake Oroville, its Upstream Tributaries, the Thermalito Complex, and the Oroville Wildlife Area.* This study plan is needed because on-going project operations affect the stage of the Feather River, which can have an effect on the surface elevation, temperature, and fish habitat of the ponds in the OWA. This is because the river is hydrologically connected to many OWA ponds through the porous alluvium physically separating the river from the ponds. In addition, large areas of the OWA have been designed to flood directly from the Feather River at certain river stages during spilling events, to attenuate the flooding effects of these high flows.

Section 4.51(f)(3) of 18 CFR requires reporting of certain types of information in the FERC Application for License for major hydropower projects, including a discussion of the fish, wildlife and botanical resources in the vicinity of the project. The discussion needs to identify the potential impacts of the project on these resources, including a description of any anticipated continuing impact for on-going and future operations of the project.

Information from this study will be used in the analysis of the impact of the Oroville Facilities on downstream special status fish, and in the development of potential protection, mitigation and enhancements (PM&Es) (resource actions) for the project.

3.0 STUDY OBJECTIVE(S)

The objective of this study report is to describe the fish species composition of the Oroville Wildlife Area from fish sampling conducted during 2002 and 2003. A listing of the fish species is presented along with a general perspective as to the relative abundance of these species. This fish species composition will provide the baseline for impact analyses within SP-F3.1, and other study plans such as SP-F2, SP-F3.2, SP-F5/7, as well as in the recreation analyses of SP-R4, SP-R13, and SP-R17. It should be noted that this study does not include the fisheries of the Feather River, which flows through the OWA. These fisheries are identified and treated in study plans SP-F3.2 and SP-F10.

4.0 METHODOLOGY

4.1 STUDY DESIGN

This study was designed to identify the fish species currently present in the OWA, as well as to generally describe their relative abundance. Because the OWA is comprised of dozens of individual ponds, as well as a complex of interconnected wetlands, it was not feasible to sample all of the waters of the area. Therefore, a single OWA pond (One-Mile Pond) that represents the general habitat and hydrologic function of the entire area was selected. One-Mile Pond is located on the west side of the Feather River about three fourths of a mile south of the Vance Avenue entrance to the OWA. It contains the various habitat types found in the ponds of the OWA, such as cobbled bottom and shoreline, seasonally flooded terrestrial vegetation such as willow and cottonwood, large beds of submerged aquatic vegetation, and emergent marsh. An additional pond (Robinson's Pond) was sampled for other purposes but the data gathered helps to add to our knowledge in this area and is included in this report. Robinson's Pond is located on the east side of the Feather River immediately adjacent to the OWA and Granite Construction (formerly Robinson's Construction). Although Robinson's Pond is not technically part of the OWA, its configuration, habitat, and close proximity to the OWA makes it a suitable representative.

Adult carp were observed on all sampling efforts however they were rarely taken into the boats livewells due to their potential to disturb the other fish.

4.2 HOW AND WHERE THE STUDIES WERE CONDUCTED

The fish species composition for the OWA was based upon boat electrofishing conducted on November 21, 2002, April 4, 2003 and June 10, 2003. One-Mile Pond was sampled using two Smith-Root SR-18 electrofishing boats on November 21, 2002 and June 10, 2003, and all sampling occurred at night. Total lengths were taken on all fish captured, and the entire shoreline was sampled except for areas too shallow to operate the boats or near locations being used by the public for fishing or other recreation. Anecdotal information, from hook and line sampling, direct observation, and angler interviews, has been collected by DWR and DFG personnel and is identified when used in this report.

One Smith Root SR-20EH was used to sample Robinson's Pond on April 17, 2003. The primary goal of this sampling was to collect tissue samples for the metals analysis for study plan SP-W2, so the sampling was biased toward larger, adult bass and carp; not all shocked fish were taken into the boat and measured.

5.0 STUDY RESULTS

Fish species captured during electrofishing in One-Mile Pond are listed in Table 5.0.1.

Table 5.0.1. Oroville Wildlife Area Electrofishing Data.

One-Mile Pond - 11/21/02

Total electrofishing seconds: 5358

Species	Total	Min Length (mm)	Max Length (mm)	Avg. Length (mm)	Percent of Total	Catch per 1000 Sec.
Black crappie (*Pomoxis nigromaculatus*)	39	140	315	234.5	6.6%	7.3
Bluegill (*Lepomis macrochirus*)	236	35	220	106.9	40.2%	44.0
Brown bullhead (*Ictalurus nebulosus*)	1	370	370	370	0.2%	0.2
Golden shiner (*Notemigonus crysoleucas*)	1	130	130	130	0.2%	0.2
Green sunfish (*Lepomis cyanellus*)	25	80	189	131.2	4.3%	4.7
Largemouth bass (*Micropterus salmoides*)	149	105	525	250.4	25.4%	27.8
Redear sunfish (*Lepomis microlophus*)	98	45	205	145.8	16.7%	18.3
Sacramento sucker (*Catostomus occidentalis*)	1	510	510	510	0.2%	0.2
Warmouth (*Lepomis gulosus*)	37	40	180	89.5	6.3%	6.9
Total	587					109.6

One-Mile Pond - 5/29/03

Total electrofishing seconds: 5559

Species	Total	Min Length (mm)	Max Length (mm)	Avg. Length (mm)	Percent of Total	Catch per 1000 Sec.
Black crappie (*Pomoxis nigromaculatus*)	14	104	273	235.9	5.3%	2.5
Bluegill (*Lepomis macrochirus*)	35	50	205	111.9	13.4%	6.3
Largemouth bass (*Micropterus salmoides*)	107	68	483	254.5	40.8%	19.2
Mosquito fish (*Gambusia affinis*)	1	40	40	40.0	0.4%	0.2
Redear sunfish (*Lepomis microlophus*)	82	80	240	161.7	31.3%	14.8
Sacramento sucker (*Catostomus occidentalis*)	2	450	521	485.5	0.8%	0.4

One-Mile Pond - 5/29/03 (Continued)

Total electrofishing seconds: 5559

Species	Total	Min Length (mm)	Max Length (mm)	Avg. Length (mm)	Percent of Total	Catch per 1000 Sec.
Sculpin spp. (*Cottus spp.*)	4	35	73	50.5	1.5%	0.7
Warmouth (*Lepomis gulosus*)	17	133	231	203.5	6.5%	3.1
Total	262					47.1

One-Mile Pond - 6/10/03

Total electrofishing seconds: 5358

Species	Total	Min Length (mm)	Max Length (mm)	Avg. Length (mm)	Percent of Total	Catch per 1000 Sec.
Black crappie (*Pomoxis nigromaculatus*)	1	206	206	206.0	0.2%	0.2
Bluegill (*Lepomis macrochirus*)	283	42	194	89.2	49.2%	65.3
Carp (*Cyprinus carpio*)	5	518	610	545.8	0.9%	1.2
Golden shiner (*Notemigonus crysoleucas*)	1	69	69	69.0	0.2%	0.2
Green sunfish (*Lepomis cyanellus*)	2	63	92	77.5	0.3%	0.5
Largemouth bass (*Micropterus salmoides*)	91	38	368	193.1	15.8%	21.0
Redear sunfish (*Lepomis microlophus*)	190	46	196	116.1	33.0%	43.9
Sacramento blackfish (*Orthodon microlepidotus*)	1	571	571	571.0	0.2%	0.2
Sacramento sucker (*Catostomus occidentalis*)	1	365	365	365.0	0.2%	0.2
Sculpin spp. (*Cottus spp.*)	1	62	62	62.0	0.2%	0.2
Warmouth (*Lepomis gulosus*)	4	96	227	179.7	0.7%	0.9
Total	580					133.9

Fish species sampled during electrofishing on Robinson's Pond (also called Granite Pond) is presented in Table 5.0.2.

Table 5.0.2 Robinson's Pond Electrofishing Data*.

Robinson's Pond - 4/17/03				
Species	**Total Sampled**	**Minimum Length (mm)**	**Maximum. Length (mm)**	**Average Length**
Carp (*Cyprinus carpio*)	2	632	648	640
Chinook salmon (*Oncorhynchus tshawytschaw*)	8	74	88	81.0
Largemouth bass (*Micropterus salmoides*)	91	38	368	193.1
Sacramento sucker (*Catostomus occidentalis*)	1	365	365	365.0
Total	102			

*It should be noted that hundreds of 100mm – 200mm hardhead were observed but not collected during this sampling

6.0 ANALYSES

The Oroville Wildlife Area is currently being managed as a warm water fishery (DFG 1990). Sufficient habitat exists in many of the ponds for the natural reproduction of warm water game fish such as largemouth bass, bluegill, redear sunfish, and crappie, reflecting the current management approach where no fish are currently being stocked, and the general fishing regulations apply. As previously described, the ponds in the OWA vary in depth and configuration, it is the deeper ponds that stay flooded year-round that possess the primary fisheries. However, some of the shallower ponds and wetland areas will contain fish during some years, due to flooding from high river levels or local runoff during periods of high precipitation. These flooding periods will raise the water in the low lying, flat areas of the OWA to a point where vast areas of water will become directly connected, not only introducing fish to ponds that will ultimately go dry, but also redistributing fish in the deeper, perennial ponds. This condition is even more significant during times of very high releases from Lake Oroville, when the Feather River may spill out of the main channel and into the OWA, exchanging fish with the river. The Feather River levees within the OWA were designed with overflow control weirs to provide this function, in order to attenuate downstream river flooding.

The fish species collected during these surveys are consistent with those reported by biologists with the DFG, DWR, and local anglers. Warm water game fish dominate the fishery, with bluegill, redear sunfish, and largemouth bass comprising 39%, 26%, and 24% of the catch, respectively. Warmouth, black crappie, and green sunfish made up another 8%, the other species accounting for less than 2% of the catch. It should be noted that the electrofishing techniques used are biased toward the capture of larger fish, significant numbers of small (< 80mm) bluegill and redear sunfish were observed but not captured in the sampling. And as previously mentioned, carp were frequently observed but seldom taken into the boats due their undesirable behavior towards other fish within the boat livewell. We estimated the number of adult carp to be approximately 5-10% of the fish observed. In addition to those species captured, channel catfish should be added to the list of species present because although they were not collected in these surveys, they have been reported by DFG and local anglers. Due to the periodic Feather River flooding events, it should be assumed that any species present in the adjacent section of the Feather River could also be found in the OWA, at least for a short period of time.

It would be impossible to determine exactly when these species became established in the Oroville Wildlife Area because many, such as largemouth bass, bluegill, warmouth, black crappie and green sunfish, were present in the area decades prior to construction of the Oroville Facilities (Dill and Cordone 1997). Since then, DFG has stocked a variety of game fish species in the OWA including largemouth bass, redear sunfish, bluegill, redear X bluegill hybrids, warmouth, black crappie, white crappie, channel catfish, white catfish, and striped bass (Hiscox 1975, 1976a, 1976b, 1978a, 1978b, 1978c). Of those species, only striped bass were not observed in the recent electrofishing. As previously

mentioned, frequent flooding events from the Feather River have introduced river dwelling species to the area, such as the Sacramento blackfish that was captured in One-Mile Pond on June 10, 2003. This is not a species stocked by DFG, and no angler caught blackfish have ever been observed by DFG or DWR personnel, therefore it is likely that this fish was introduced during the flooding events of the late 1990s.

Juvenile salmonids were observed in an OWA wetland (See 1995, Unp. data) area during the spring of 1995 following a Feather River high flow event. This event not only overflowed the control weirs, but actually broke through the levee creating a temporary river channel through the OWA. The OWA only connects directly with the Feather River during these high flow events, so the presence of salmonids does not occur every year. The OWA ponds and wetland areas become too warm during the late spring to sustain salmonids, so any present will not survive past this time. The extent of this periodic salmonid presence, as well as the stranding impact has not been determined. Juvenile Chinook salmon were observed during the sampling for this study on April 17, 2003, while electrofishing Robinson's Pond (Table 5.0.2). Additional juvenile Chinook were observed in the pond, however they were not sampled to avoid potential impacts to these fish. This pond does not create a definite stranding issue since it is continuously connected to the Feather River via a large side channel.

The primary warm water fish species found in the OWA such as largemouth bass, bluegill, redear sunfish and black crappie, are common game fish in California's recreational fisheries, and particularly in the case of largemouth bass and black crappie, are very popular with anglers. Therefore, the current fish species composition satisfies the species necessary for an acceptable recreational fishery, however this study was not designed to identify the specific quality of the OWA fishery. With that in mind, it is possible to make several inferences on the status of the OWA fishery and how it may be managed to maximize its potential. For example, based upon the low percentage of "quality" sized bluegill ($\geq$ 150mm) observed in the sampling conducted in this study, it appears that a stunted population is present in One-Mile Pond, and this conclusion is consistent with observations made in other OWA ponds by DWR personnel. Bluegill can provide an acceptable fishery under certain conditions, however their tendency toward overpopulation and stunting has made them undesirable in many recreational fisheries (Moyle 2002, McGinnis 1984). It is possible for this condition to limit the success of other game fish such as largemouth bass, particularly when combined with high harvest of the bass (Calhoun 1966). Anecdotal observations made by DWR personnel, where the number and size of largemouth bass is greater in the more remote areas of the OWA, suggest that harvest is affecting the number and size of largemouth bass in One-Mile Pond, and probably other easily accessible OWA waters. The bass fishing regulations in the OWA, which allow 5 bass over 12 inches long to be kept, is among the most liberal of the bass fishing regulations available in California. This may be combining with other factors, such as the sunfish (bluegill and redear) overpopulation, to result in an overall reduction in the success of the bass fishery.

Further consideration of factors such as these, combined with consultation with DFG recreational fishery managers, will be essential in determining the future fishery management strategy for the OWA.

The most significant issue affecting the OWA fisheries in the last decade has been the invasion of water primrose (*Ludwigia peploides peploides)* in the OWA on the east side of the Feather River. Water primrose is a native aquatic plant that is currently found along the margins and backwaters of the Feather River both upstream and downstream of the OWA, and has been increasing in abundance since at least the mid-1990s. Since the 1997 floods, which broke through the OWA levee on the east side of the river near the Pacific Heights Road entrance, a small flow of water has been passing through this area. Beavers have created a series of dams using this flow, which has spread the water across hundreds of acres of land that previously only flooded on a seasonal basis. Now this shallow water is standing year-round, providing ideal conditions for the growth of water primrose and its abundance has increased dramatically since this time. The excessive amount of primrose in these former seasonally flooded areas has spread across the deeper, perennial, fish bearing ponds to a point where the entire surface of the pond is covered with water primrose, sometimes to a height of over 1 m above the surface of the pond. High abundance of aquatic plants can have negative impacts in recreational fisheries through reduced angler access and effectiveness, as well as declines in largemouth bass foraging success and population skewing toward smaller fish (Dibble et al. 1996; Killgore et. al. 1989; Wrenn et. al. 1996). Recent observations by DWR biologists, DFG personnel, as well as angler accounts, have estimated that 80% of the fish bearing ponds in this area have been covered with water primrose, and this condition is increasing annually. A proposed Resource action (EWG-29) may address this issue, and may include techniques such as water management, beaver and/or beaver dam management, aquatic plant removal with the use of mechanical equipment and/or chemical controls, and other suitable methods.

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7.0 REFERENCES

Calhoun, A. 1966. Inland Fisheries Management. California Department of Fish and Game. p. 305.

Dibble, E. D., Killgore, K.J., and S.L. Harrel, 1996. Assessment of fish-plant interactions. Pages 357-372 *in* L.E. Miranda and D.R. Devries, editors. Multidimensional Approaches to Reservoir Fisheries Management. American Fisheries Society, Symposium 16.

Dill, W.A., and A.J. Cordone. 1997. History and status of introduced fishes in California, 1871-1996. California Department of Fish and Game, Fish Bulletin 178. pp. 144-179.

DFG, 1990. Draft Management Plans for Oroville and Spenceville Wildlife Areas. California Department of Fish and Game, Wildlife Management Division.

Hiscox, J. 1975. Memo to Dave Johnson, DFG Wildlife Management. Recent Plants of Fish on Oroville Recreation Area. June 19, 1975. California Department of Fish and Game, Region 2.

Hiscox, J. 1976a. Monthly Report, Warmwater Reservoir Study, March 1976. California Department of Fish and Game, Region 2.

Hiscox, J. 1976b. Memo to Dave Johnson, DFG Wildlife Management. Fisheries Management Synopsis for Oroville Wildlife Area. June 22, 1976. California Department of Fish and Game, Region 2.

Hiscox, J. 1978a. Monthly Report, Warmwater Reservoir Study, May 1978. California Department of Fish and Game, Region 2.

Hiscox, J. 1978b. Monthly Report, Warmwater Reservoir Study, June 1978. California Department of Fish and Game, Region 2.

Hiscox, J. 1978c. Monthly Report, Warmwater Reservoir Study, July 1978. California Department of Fish and Game, Region 2.

Killgore, K.J., Morgan, R.P II., and N.B. Rybicki. 1989. Distribution and abundance of fishes associated with submersed aquatic plants in the Potomac River. North American Journal of Fisheries Management 9:101-111.

McGinnis, S.M. 1984. Freshwater Fishes of California. University of California Press. pp. 206-207.

Moyle, P. B. 2002. Inland Fishes of California. University of California Press. p. 384.

See, E. May 1995. Unpublished Data.

Wrenn, W.B., Lowery, D.R., Maceina, M.J., and W.C. Reeves. 1996. Relationship between largemouth bass and aquatic plants in Guntersville, Reservoir, Alabama. Pages 382-393 *in* L.E. Miranda and D.R. Devries, editors. Multidimensional Approaches to Reservoir Fisheries Management. American Fisheries Society, Symposium 16.